CLAIMS

1. A brush-less resolver comprising:

excitation signal transmitting means for transmitting a resolver excitation signal from the stator side to the rotor side in a non-contact manner; and

a resolver section for modulating said resolver excitation signal corresponding to the rotation angle to be detected,

wherein said resolver section also serves as said excitation signal transmitting means.

2. The brush-less resolver according to claim 1, wherein said resolver section is constructed of a set of a rotor which has a slot and is made up of a rotor iron core provided with a coil (also referred to as "rotor coil") and a stator which has a slot and is made up of a stator iron core provided with a coil (also referred to as "stator coil").

3. The brush-less resolver according to claim 2, wherein said stator coil comprises a stator excitation coil section which is a coil excited by an AC voltage for transmitting a resolver excitation signal to said rotor and a stator output coil section which is a coil for outputting a signal corresponding to the rotation to be detected and appearing on said rotor,

said stator excitation coil section and said stator output coil section are provided on the same single stator iron core,

said rotor coil constitutes a rotor excitation coil which is a coil to receive a resolver excitation signal transmitted from said stator excitation coil section and a rotor output coil which is a coil to generate an output signal to said stator output coil section, and

said rotor excitation coil and said rotor output coil are provided on the same single rotor iron core.

4. The brush-less resolver according to claim 2 or 3, wherein at least one of the rotor shaft or case is omitted.

5. The brush-less resolver according to claim 3 or 4, wherein said stator comprises a stator excitation coil section which is a coil excited by an AC voltage for transmitting a resolver excitation signal to said rotor and a stator output coil section which is a coil for outputting a signal corresponding to the rotation angle to be detected and appearing on the rotor,

at least one of said stator excitation coil section or said stator output coil section is provided with coils with two phases; one having a sine-wave distribution and the other having a phase shifted by 90° (hereinafter referred to as "phases differing 90° from each other" or "phases differing from each other"), and

said rotor comprises a rotor coil section including a rotor excitation coil which is a coil to receive a resolver excitation signal transmitted from said stator excitation coil section and a rotor output coil which is a coil to generate an output signal to said stator output coil section, and

said rotor excitation coil and said rotor output coil are coils with phases differing 90° from each other.

6. The brush-less resolver according to claim 5, wherein both said stator excitation coil section and said stator output coil section are provided with coils with two phases differing 90° from each other and it is possible to select from among three types of signal processing system; 2-phase excitation 2-phase output, 1-phase excitation 2-phase output or 2-phase excitation 1-phase output by selecting a phase with which an excitation voltage is applied and a phase with which an output signal is extracted.

7. The brush-less resolver according to any one of claims 3 to 6, wherein it is possible to obtain an angle signal with the number of revolutions N times one rotation of the resolver (N is an integer equal to or greater than 1 and an arbitrary number) by arbitrarily setting at least any one of combinations of the number of slots of any one of said stator iron core or said rotor iron core,

the number of pole pairs in an excitation function block made up of said stator excitation coil section and said rotor excitation coil and the number of pole pairs in an output function block made up of said stator output coil section and said rotor output coil.

8. The brush-less resolver in any one of claims 5 to 7, wherein the relationship between the number of pole pairs m in said excitation function block and number of pole pairs n in said output function block is m-n=1 (where both m and n are positive integers and arbitrary numbers), opposite phases in phase rotation are set in the wiring between the rotor excitation coil and the rotor output coil in said rotor, thereby constructing a resolver with an axial double angle 1 capable of obtaining an angle signal corresponding to one rotation by one rotation of the resolver.

9. The brush-less resolver in any one of claims 5 to 7, wherein the relationship between the number of pole pairs m in said excitation function block and number of pole pairs n in said output function block is n-m=1 (where both m and n are positive integers and arbitrary numbers), opposite phases in phase rotation are set in the wiring between the rotor excitation coil and the rotor output coil in said rotor, thereby constructing a resolver with an axial double angle 1 capable of obtaining an angle signal corresponding to one rotation by one rotation of the resolver in the opposite rotation direction.

10. The brush-less resolver in any one of claims 5 to 7, wherein in order to prevent interference of magnetic flux between a resolver excitation signal in said excitation function block and an output signal in said output function block, the number of pole pairs m in said excitation function block is made different from the number of pole pairs n in said output function block (where, both m and n are positive integers and arbitrary numbers).

11. A method of constructing the brush-less resolver in any one of claims 5 to 7, comprising a step of arbitrarily setting at least any one of combinations of the number of slots of at least one of said stator iron core or said rotor iron core, the number of pole pairs in said excitation function block

and the number of pole pairs in said output function block so as to construct a brush-less resolver capable of obtaining an angle signal with the number of revolutions N times one rotation of the resolver (where N is an integer equal to or greater than 1 and an arbitrary number).

12. The method of constructing the brush-less resolver in any one of claim 5 to 7, wherein the number of pole pairs m in said excitation function block is made different from the number of pole pairs n in said output function block (where, both m and n are positive integers and arbitrary numbers) so as to prevent interference between an excitation signal and an output signal.

13. The method of constructing the brush-less resolver according to claim 12, wherein pole pairs are arranged so that the difference between the number of pole pairs m in said excitation function block and the number of pole pairs n in said output function block becomes 1 to thereby obtain an angle signal corresponding to one rotation by one rotation of the resolver, and when a resolver having an axial double angle 1 in the same rotation direction is obtained, the poles are constructed so that the relationship between m and n becomes m-n=1, whereas when a resolver which generates an angle signal whose rotation direction is opposite and whose amount of rotation corresponds to one rotation is obtained, the poles are arranged so that the relationship between m and n becomes n-m=1 and opposite phases in phase rotation are set in the wiring between the rotor excitation coil and the rotor output coil in said rotor (where both m and n are positive integers and arbitrary numbers).

14. A brush-less resolver rotor, said rotor comprising an iron core having a slot provided with 2-phase coils, wherein said 2-phase coils are coils having phases differing 90° from each other for modulating a resolver signal.

15. A coil structure for a brush-less resolver, the brush-less resolver having a resolver section comprising a stator excitation coil section made up of 2-phase coils, a stator provided with a coil which constitutes a stator output coil

section and a rotor provided with coils having a total of two phases of a rotor excitation coil and rotor output coil,

wherein when the number of pole pairs in the excitation function block made up of said stator excitation coil section and said rotor excitation coil is m,

(A) when an excitation voltage is applied to both of the two phases in said stator excitation coil section, two signals E_3 and E_4 expressed by:

[Expression] $E_3=K_1E\sin(\omega t+m\theta)$, $E_4=K_1E\cos(\omega t+m\theta)$

are obtained for the coils of said rotor,

(B) when an excitation voltage is applied to only one phase in said stator excitation coil section, two signals E_3 and E_4 expressed by:

[Expression] $E_3=K_1E_1\cos(m\theta)$, $E_4=K_1E_1\sin(m\theta)$

are obtained for the coils of said rotor,

(where, suppose K_1 is a transformer ratio, E is an input signal, E_1 is an excitation signal, ω is an angular velocity, t is a time and θ is a rotation angle).

16. The coil structure for a brush-less resolver according to claim 15, wherein excitation signals E_1, E_2 and output signals E_5, E_6 of the brush-less resolver are expressed by,

(I) when the signal processing system is 2-phase excitation 2-phase output

[Expression] $E_1=E\sin\omega t$ ---- <1>

$E_2=E\cos\omega t$ ---- <2>

$E_5=KE\sin\{\omega t+(m+n)\theta\}$ ---- <5>

$E_6=KE\cos\{\omega t+(m+n)\theta\}$ ---- <6>

where when the wiring between the input and output coils in the rotor is changed and the phase rotation is changed, the output signals are expressed by,

[Expression]

$E_5=KE\sin\{\omega t+(m-n)\theta\}$ ---- <7>

$E_6=KE\cos\{\omega t+(m-n)\theta\}$ ---- <8>

(II) when the signal processing system is a 1-phase excitation 2-phase output, the output signals are expressed by,

[Expression] $E_1=E\sin\omega t$ ---- <1>

$E_5=KE_1\cos\{(m+n)\theta\}$ ---- <11>

$E_6=KE_1\sin\{(m+n)\theta\}$ ---- <12>

where when the wiring between the input and output coils in the rotor is changed and the phase rotation is changed, the output signals are expressed by,

[Expression]

$E_5=KE_1\cos\{(m-n)\theta\}$ ---- <13>

$E_6=KE_1\sin\{(m-n)\theta\}$ ---- <14>

(III) when the signal processing system is a 2-phase excitation 1-phase output, the output signals are expressed by,

[Expression] $E_1=E\sin\omega t$ ---- <1>

$E_2=E\cos\omega t$ ---- <2>

$E_5=KE\sin\{\omega t+(m+n)\theta\}$ ---- <17>

where when the wiring between the input and output coils in the rotor is changed and the phase rotation is changed, the output signals are expressed by,

[Expression]

$E_5=KE\sin\{\omega t+(m-n)\theta\}$ ---- <18>

(where, suppose K is a transformer ratio, E is an input signal, ω is an angular velocity, t is a time, θ is a rotation angle, m is the number of pole pairs in the excitation function block and n is the number of pole pairs in the output function block).